

## Studies on Cercariae from Kuwait Bay. IX. Description and Surface Topography of *Cercaria kuwaitae* IX sp. n. (Digenea: Zoogonidae)

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**ABSTRACT:** A new zoogonid cercaria, *Cercaria kuwaitae* IX sp. n., from the prosobranch gastropod *Umbonium vestiarium* (Linnaeus) from Kuwait Bay is described. Surface topography of the sporocyst and the cercaria is studied by scanning electron microscopy. The new cercaria is compared with the previously described zoogonid cercariae. This is the first zoogonid cercaria to be recorded from a gastropod from the Arabian Gulf region and the second to be reported from an archaeogastropod host.

**KEY WORDS:** Digenea, *Cercaria kuwaitae* IX sp. n., Zoogonidae, cercaria, ultrastructure, *Umbonium vestiarium*, Kuwait Bay.

Adult digenetic trematodes of the family Zoogonidae Odhner, 1902, live in the digestive tracts of fishes (Bray and Gibson, 1986). The larval stages utilize prosobranch gastropods as first intermediate host and a wide range of benthic invertebrates, particularly polychaetes and echinoderms, as second intermediate host (Stunkard, 1938, 1943; K  ie, 1976). Zoogonid cercariae are tailless xiphidiocercariae (cercariaeum) produced in daughter sporocysts in the digestive gland and gonad of the first intermediate host. Larval zoogonids have been recorded in gastropods from both subtropical and temperate zones, including Chilka Lake, India (Madhavi and Shameem, 1991), the Black Sea (Sinitzin, 1911; Dolgikh, 1970), the Gulf of Mexico (Wardle, 1993), the Mediterranean Sea (Palombi, 1930; Stunkard, 1932), the North Sea (Lebour, 1911; K  ie, 1969), and the western Atlantic Ocean (Linton, 1915; Miller and Northup, 1926; Stunkard, 1943).

The trochid gastropod *Umbonium vestiarium* is a common inhabitant of sandy shores of the Indo–Western-Pacific region. Although several species of gastropods in Kuwait Bay are known to host digenetic trematodes (Abdul-Salam and Sreelatha, 1991; Abdul-Salam and Al-Khedery, 1992; Abdul-Salam et al., 1994), there are no references to parasitic associations in *U. vestiarium*. The present study describes a new larval zoogonid from *U. vestiarium*.

### Materials and Methods

Naturally infected specimens of *Umbonium vestiarium* were collected from the Towers Beach in

Kuwait City, southern Kuwait Bay, during February–June 1995. The shells of snails were crushed, and the soft parts were examined under a dissecting microscope. Cercariae were studied live, unstained or vitally stained with 5% neutral red, and after fixation in hot acetic acid–formalin–alcohol (AFA) and staining in acetocarmine. As naturally released cercariae were not found, it was necessary to use the most mature specimens found in snail tissues. Measurements in micrometers, with averages in parentheses, were taken from 20 AFA-fixed specimens. Figures were drawn with the aid of a camera lucida from vitally stained specimens. For scanning electron microscopy, living cercariae and daughter sporocysts were fixed in a solution containing 4% formaldehyde and 1% glutaraldehyde in 0.1 M phosphate buffer (pH 7.2) at 4  C. Following the appropriate buffer wash, the specimens were postfixed in 1% osmium tetroxide in the same buffer for 5 min at 4  C, were dehydrated in a series of anhydrous acetone, and were critical-point dried. The specimens were coated with gold–palladium and then were examined in a Jeol JSM-6300 scanning electron microscope.

The nomenclature for the new cercaria follows the system of Cable (1956) from Sewell (1922).

### Results

#### *Cercaria kuwaitae* IX sp. n.

(Figs. 1–7)

**DESCRIPTION:** Tailless xiphidiocercariae, body oval, 145–193 (165) long, 53–68 (58) wide. Tegument thick with prominent spines. Body containing abundant refringent granules, rendering body opaque. Oral sucker subterminal, circular, 35–40 (36) long, 30–35 (32) wide. Stylet anteriodorsal to oral sucker, lanceolate, about 0.02 long. Prepharynx very short, pharynx 10–15 (13) long, 12.5 wide. Esophagus 15–30 (25) long, bifurcating in posterior forebody, ceca short, somewhat saccular, terminating anterior to ventral sucker, containing ingesta that stain or-

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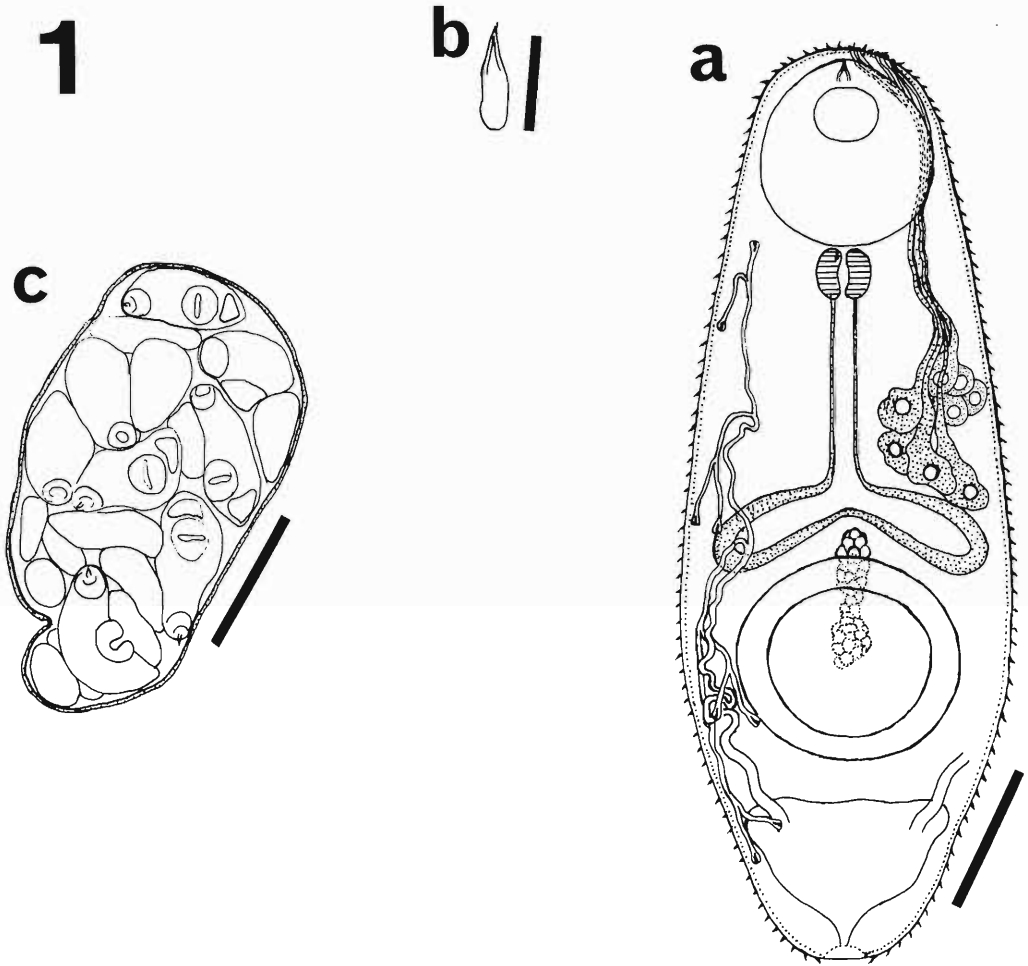


Figure 1. *Cercaria kuwaitae* IX sp. n. from the trochid gastropod *Umbonium vestiarium*. a. Cercaria, ventral view. Scale bar = 50 µm. b. Stylet. Scale bar = 13 µm. c. Sporocyst. Scale bar = 250 µm.

ange with neutral red. Ventral sucker posterior to midlevel of body, protrusible, 40–53 (45) long, 40–48 (44) wide. Eight pairs of penetration glands, anteriolateral to ventral sucker, disposed in 2 levels, 4 anterior and 4 posterior, each gland irregular in shape with prominent nucleus and fine granular cytoplasm, posterior group staining deeply with neutral red. Ducts of penetration glands in 2 narrow bundles opening through pores lateral to stylet. Genital primordia elongated mass, dorsal to ventral sucker. Excretory bladder saccate, nonepithelial, containing yellowish material; excretory pore surrounded by sphincter. Primary collecting ducts arising from each side of bladder near its anterior end, dividing posterior to ventral sucker. Flame cell

formula  $2[(2 + 2) + (2 + 2)] = 16$ . Sporocyst an oval sac, thin-walled, nonpigmented, 180–320 (269) long, 130–230 (161) wide, containing 2–6 (4) mature cercariae and germ balls.

HOST: *Umbonium vestiarium* Linnaeus, 1758 (Prosobranchia: Trochidae).

LOCALITY: Towers Beach, Kuwait City, Kuwait Bay.

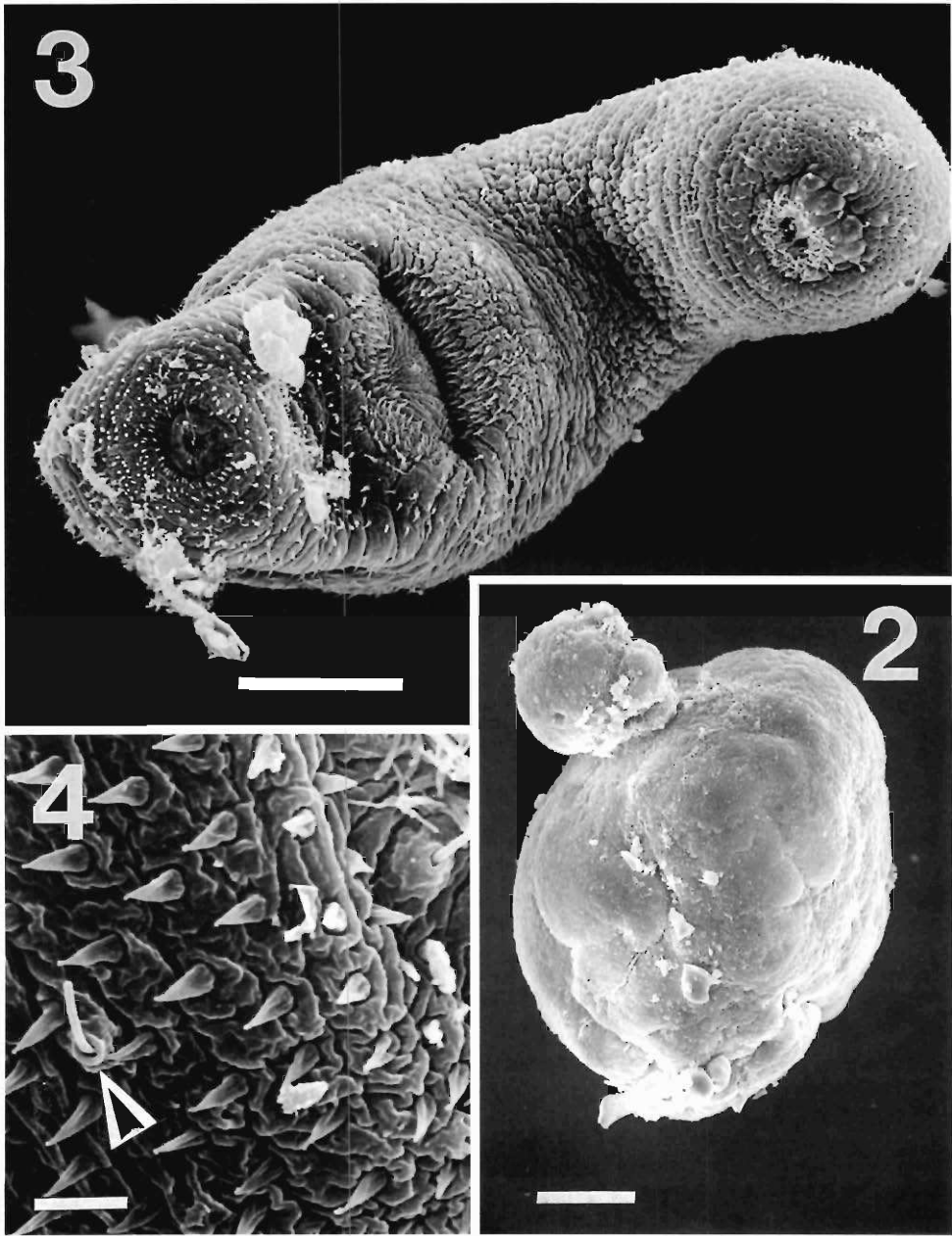
HABITAT: Sandy substrate.

INFECTION SITE: Gonad and hepatopancreas.

PREVALENCE OF INFECTION: 4 of 385 snails (1.0%).

SPECIMENS DEPOSITED: Helminth Collection, Department of Biological Sciences, Kuwait University (Accession No. KUH-C-ZGI).

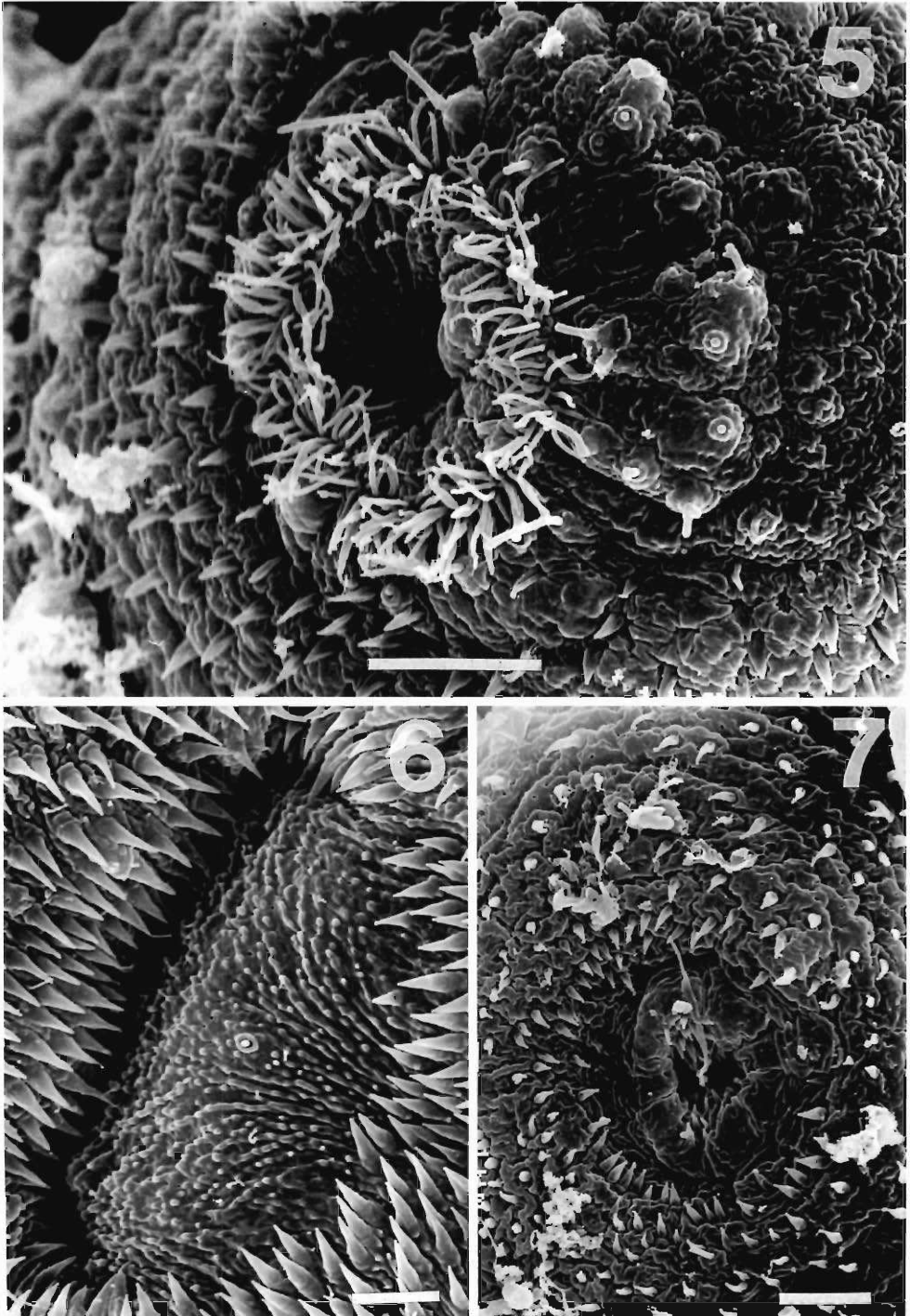
SCANNING ELECTRON MICROSCOPY OBSERVA-



Figures 2–4. Scanning electron micrographs of *Cercaria kuwaitae* IX sp. n. from the trochid gastropod *Umbonium vestiarium*. 2. Mature sporocyst showing irregularly shaped spherical mass. Scale bar = 30  $\mu$ m. 3. Ventral view of entire cercaria showing tegumental annulations and spines, ventral and oral suckers, and excretory pore. Scale bar = 20  $\mu$ m. 4. Tegument posterior to oral sucker showing concentrically arranged peglike spines and ciliated sensory papilla (arrowhead). Scale bar = 3  $\mu$ m.

TIONS: Sporocyst appears as irregular spherical mass with rough outer surface (Fig. 2). Cercaria is elongate cylinder with rounded anterior end and slightly blunt posterior end (Fig. 3). Body

surface is folded into circumferential ridges bearing rows of spines with simple tips and few ciliated sensory papillae, each with a cilium arising from a circular tegumental collar (Fig. 4).



Figures 5–7. Scanning electron micrographs of *Cercaria kuwaitae* IX sp. n. from the trochid gastropod *Umbonium vestiarium*. 5. Subterminal region showing oral sucker fringed by long microvilli and sensory papillae, each with a cilium protruding from a tegumental swelling. Scale bar = 4  $\mu$ m. 6. Ventral sucker with lips armed with spikelike spines, and internal surface covered with fine tubercles and bearing a centrally located ciliated sensory papilla. Scale bar = 3  $\mu$ m. 7. Posterior end showing excretory opening surrounded by a sphincter. Tegumentary spines and minute pores are prominent at this area. Scale bar = 3  $\mu$ m.

Tegumental spines are dense around oral sucker and excretory pore. Surface tegument bears minute pores. Oral sucker is transversally oval, fringed by 1- $\mu$ m-long microvilli and sensory papillae, each with a cilium up to 2- $\mu$ m long protruding from a tegumental mound (Fig. 5). Sensory papillae around oral sucker are disposed single or in groups of 2–4. Ventral sucker is transversally elongate with protruding anterior and posterior lips (Fig. 6). Sucker lips are armed with inwardly directed stout spikelike spines, about 2- $\mu$ m long. Surface of ventral sucker is covered with fine tubercles (microvilli) and bears a centrally located ciliated sensory papilla. Ventral sucker region is devoid of sensory papillae. Excretory pore is surrounded by protrusible sphincter (Fig. 7).

### Discussion

This is the first report of natural infection of the trochid gastropod *Umbonium vestiarium* with a zoogonid larva in the Arabian Gulf region and the second report of a zoogonid infection in an archaeogastropod in addition to the turbinid *Batillus cornutus* host of *Cercaria brachycaeca* (see Shimura and Ito, 1980). All the other previously reported gastropod hosts for zoogonids (tabulated by Madhavi and Shameem, 1991) are neogastropods belonging to genera of the superfamily Buccinidae, i.e., *Buccinum*, *Mitrella*, *Nassarius*, *Natica*, and *Peuroploca*.

Members of the family Zoogonidae Odhner, 1902, have a distinctive type of tailless xiphidiocercariae. So far, only 8 species of zoogonid larvae have been reported worldwide. *Cercaria kuwaitae* IX sp. n. differs from the cercariae of *Zoogonoides laevis* Linton, 1940, *Zoogonus lasius* (Liedy, 1891) Stunkard, 1940, *Zoogonus rubellus* (Olsson, 1868) Odhner, 1902, and *Cercaria chilkaensis* Madhavi and Shameem, 1991, in having intestinal ceca that do not extend posterior to ventral sucker. The present cercaria is similar to the cercariae of *Diptherostomum brusinae* Stossich, 1904 (synonym: *Cercaria inconstans* Sinitzin, 1911), *Cercaria brachycaeca*, and *Cercaria* sp. 'A' Wardle, 1993, in having short and stout ceca but differs in having 8 pairs of penetration glands disposed in 2 levels. The present cercaria differs from the cercaria of *Zoogonoides viviparus* (Olsson, 1868) Odhner, 1902, in its very short prepharynx and lack of dislike posterior end. Other differences between the new species and the previously re-

ported species are in body size, molluscan host species, and geographic locality.

The surface topography and associated structures of the present cercaria, as revealed by scanning electron microscopy, does not differ essentially from that of the cercaria of *Zoogonoides viviparus* (see K  ie, 1971). In contrast to larvae and adults of most other trematodes, the ventral sucker of the present cercaria is devoid of dome-shaped papillae and bears a centrally located ciliated papilla. Suckers of the new cercaria are fringed by characteristically long microvilli. Similar structures have been observed in some opecoelid (Lo et al., 1975) and gymnophallid (Russell-Pinto et al., 1996) cercariae. In *Z. viviparus* cercaria, K  ie (1976) reported the gradual disappearance of microvilli surrounding the suckers after encystment and suggested that they may be involved in nutrient absorption during migration in the molluscan host.

### Acknowledgment

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## Obituary Notice

JAMES H. TURNER

13 June 1922–24 December 1997

Elected to Membership 9 March 1949

Recipient of the First Brayton H. Ransom  
Memorial Award 8 October 1960